

## UNRELIABILITY & INSTABILITY OF WIRELESS LINKS BETWEEN WIRELESS NODES IN MOBILE AD HOC NETWORKS - MANET

Jawad Ahmad<sup>\*1</sup>, Muhammad Zaman<sup>2</sup>, Maryam Azhar<sup>3</sup>, Arif Nawaz<sup>4</sup>, Sammar Abbas<sup>5</sup> and Umer Idrees<sup>6</sup>

Department of Computer Science, University of Agriculture, Faisalabad, Punjab, Pakistan

<sup>\*</sup>Corresponding Author's e.mail: [jawadahmad212@gmail.com](mailto:jawadahmad212@gmail.com)

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In this paper, It is discussed that why Mobile Ad Hoc Networks are unreliable and some other issues with link stability between the nodes. Then their current solutions are suggested. On the behalf of the vulnerable nature of the MANET, these vulnerabilities disturb the development of mobile ad hoc networks. On the base of these vulnerabilities it is proved that mobile ad hoc networks are unreliable & instable Networks. While in the other part, the mechanism to reduce the unreliability & instability of the wireless link between the devices discussed. Ended up by suggesting some ideas and the solutions that makes Mobile Ad hoc network reliable and stable links between the nodes.

**Keywords:** MANET, DSR, Limited Energy Supply, Broadcast Storm, Mobile Nodes

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### INTRODUCTION

A Mobile Ad hoc Network (MANET) is a type of Computer Networks in which wireless mobile nodes can dynamically change its position and can again self-organize in unstructured random and temporary network topologies. In this type of network there is no permanently fixed infrastructure exists. However some wireless nodes / devices assembled in any shape of topology on a temporary basis to work for a specific area or deployment like emergency rescue and battlefield communication. These networks are specifically suitable for scenario where the deployment of a network infrastructure is either not possible or not cost effective.

From last couple of years the development and usage of mobile computing devices growing up rapidly, which includes mobiles, laptops, mobile PCs, Personal Digital Assistants (PDAs) and handheld digital devices. These mobile computing devices have encouraged an innovative revolution in the computing domain. Computing will not rely on the ability provided by the personal computers, and the concept of universal computing occurs and becomes one of the research hotspots in the computer science society. In the universal computing environment, individual users utilize, at the same time, several electronic platforms through which they can access all the required information whenever and wherever they may be. The nature of the universal computing has made it necessary to adopt wireless network as the interconnection method: it is not possible for the universal devices to get wired network link whenever and wherever they need to connect with other universal devices. That's why; the Mobile Ad Hoc Networks (MANETs) is attracting most attentions from many researchers for advance level research.

In spite of the some weaknesses, the uses of Mobile Ad hoc Network is increasing day by day. These networks provide

rapid deployment and self-configuration capabilities and have applications in a variety of environments such as battlefields, disaster recovery and environmental monitoring. MANET is available in the daily routine environment such as home, office, etc. Now furthermore, the application growth of MANET is increasing at many platforms of industrial and Government level.

### ISSUES

Due to following facts the wireless links between mobile devices / nodes, MANET are not so much consistent & reliable for communication participants / users in a specific area.

1. *Limited energy supply*
2. *Constantly changing topology due to Mobility of the Nodes*
3. *Broadcasting Storm*

Because of the features listed above, the mobile ad hoc networks are more prone to suffer from the malicious behaviors than the traditional wired networks. Therefore, it is necessary to pay more attention on these issues in the mobile ad hoc networks to eliminate these vulnerabilities.

**Limited Energy Supply:** Power management is a serious and sensitive issue specially occurs in wireless mobile ad hoc networks where the energy supply is limited. Due to the mobility of nodes in the ad hoc mobile network, it is common that the nodes in the ad hoc network will rely on battery as their power supply method. While nodes in the wired network do not need to consider the power supply problem because they can get electric power supply from the outlets, which generally mean that their power supply should be approximately infinite; the nodes in the mobile ad hoc network need to consider the restricted battery power,

which will cause several problems. In which a problem that may be caused by the limited power supply is denial of service attacks. It is happened when the opponent node knows that the target node have a limited energy supply. Then either the opponent node can send additional packets constantly to the target node for maximum utilization of the battery for routing those additional packets or it can keep the target node in some kind of time-consuming computations. In this situation, the energy supply of battery of the target node will be consumed by attempting to complete these meaningless tasks, and then the target node will be switched off and will not be available for onward communication or to provide services to all other nodes since it has run out of power. Furthermore, a node in the MANET may act in a selfish manner when the nodes finds that there is insufficient power supply, and the selfishness can source of some issues when there is a need of cooperation of one node for another nodes to communicate with each other or to operate some jobs in the network.

**Solution and method:** In this paper, this mainly problem has investigated and proposed a way out with routing paradigm, Message Ferrying (MF), to save and protect energy while dealing data delivery delay. (Message ferrying is a networking protocol model where a special node, called a message ferry, facilitates the connectivity in a mobile ad hoc network where the nodes are sparsely deployed.)

In MF, special nodes called ferries move around the deployment area to deliver messages for nodes. The reliance on the movement of ferries to deliver data increases the delivery delay. However, nodes can save energy by disabling their radios when ferries are far away. To exploit this feature, a power management framework has represented, in which nodes switch their power management modes based on the knowledge of ferry location.

Figure 5 shows an example scenario in which a node switches its power management mode according to the location of the ferry. A node is in the sleeping mode when the ferry is out of radio range. When it expects to meet the ferry in the near future, it switches to the searching mode and wakes up periodically to listen for a beacon. After receiving the first beacon, it switches to the communicating mode and frequently wakes up to communicate with the ferry. Finally, when the ferry leaves the radio range, the node switches to the sleeping mode again.

***Constantly changing topology due to mobility of the nodes:***

In Mobile Ad hoc Network the topology of the network is not under our control because there is no specific infrastructure of networking. Due to the continuous motion of nodes, the topology of the mobile ad hoc network changes constantly: the nodes can continuously move into and out of the radio range of the other nodes in the MANET, and the routing information will be changing all the time because of the movement of the nodes. Due to continuously movement of the nodes the topology of the network changes relatively. Sometimes the topology sets according to Mesh Topology but due to movement of the nodes some new nodes attach to the network and some nodes disconnected

due to not in range and the result is change in the topology in other shape Mesh, Star etc. In the mobile ad hoc network, nodes directly communicates with all the adjacent nodes within their radio ranges. Whereas nodes that not in the direct communication range use intermediate nodes to communicate with each other.

One of the key challenges under this scenario is the design of routes to achieve certain properties of end-to-end connectivity, such as, delay and message loss among the nodes in the ad hoc network. This is a difficult problem when the nodes in the network move arbitrarily. As it cannot be assured of the location of the nodes, route cannot be designed / determined where the nodes can contact the other nodes with confidence.

Because the topology of the ad hoc networks is changing constantly, it is necessary for each pair of adjacent nodes to incorporate in the routing issue so as to prevent some kind of potential attacks that try to make use of vulnerabilities.

**Solution and method:** To overcome the routing issue a solution in shape of a Routing Protocol named *Dynamic Source Routing Protocol (DSR)* has been suggested. The Dynamic Source Routing protocol (DSR) is very easy to implement and very effective routing protocol. This routing protocol is specifically designed for networks like Mobile Ad Hoc Networks which have multi hops. DSR Protocol is very helpful in communication between the nodes because it used self-organizing and self-configuring mechanism to determine the routes. One main feature is there is not required any physical network infrastructure or administration to implement this routing protocol. In respect of operations, DSR protocol has two parts in which one "Route Discovery" and the second is "Route Maintenance". Collectively these operations work together to allow nodes to determine and maintain routes of other nodes that are changing their destinations constantly and changing topology in Mobile Ad Hoc Networks. All the features of this routing protocol operate entirely on demand, allowing the routing packet overhead of DSR to scale automatically to only what is needed to react to changes in the routes currently in use. The protocol allows multiple routes to any destination and allows each sender to select and control the routes used in routing its packets, for example, for use in load balancing or for increased robustness. Other advantages of the DSR protocol include easily guaranteed loop-free routing, operation in networks containing unidirectional links, use of only "soft state" in routing, and very rapid recovery when routes in the network change. The DSR protocol is designed mainly for mobile ad hoc networks of up to about two hundred nodes and is designed to work well even with very high rates of mobility.

Dynamic Source Routing (DSR), is a unicast routing protocols as Ad Hoc on Demand Distance Vector (AODV), Location Aided Routing (LAR), and Zone Routing Protocol (ZRP), as well multicast protocols employ broadcasting to detect and maintain routes in a dynamic environment. Currently, these protocols typically rely on simplistic form of broadcasting called simple flooding, in which each mobile node retransmits every unique received

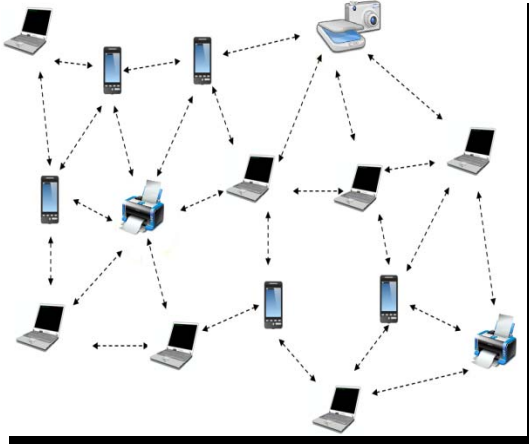


Fig. 1: (Mobile Ad Hoc Network overview)

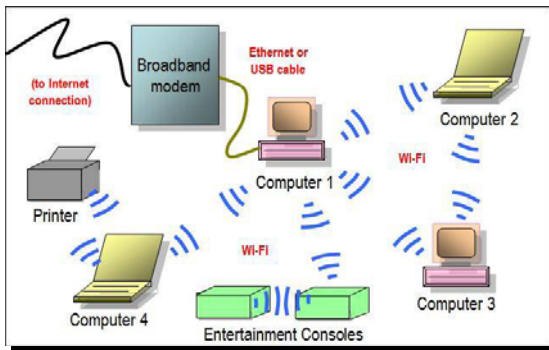


Fig. 2: (MANET at Home / Office MANET)

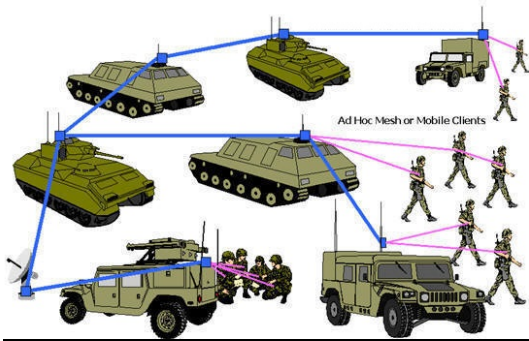


Fig. 3: (MANET in Military/Battlefield)

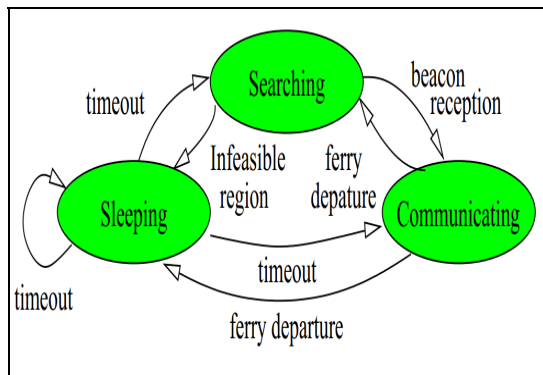


Fig. 4: (Transition among power management modes in M.F Paradigms)

packet exactly once. Although flooding is simple and easy to implement, it often causes unproductive and harmful bandwidth congestion, a phenomenon referred to as the broadcast storm problem which is defined as under but still remained for future work.

**Broadcasting storm:** The process of Broadcasting in a network environment is commonly used to resolve many problems and issues during the communication of nodes. In a mobile ad hoc network (MANET), due to host mobility, some operations are expected to be executed more frequently (such as finding a route to a particular host, paging a particular host, and sending an alarm signal). Because radio signals are likely to overlap with others in a geographical area, a straight forward broadcasting by flooding is usually very costly and will result in serious redundancy, contention, and collision, to which can be referred as the broadcast storm problem

A MANET consists of a set of mobile hosts that may communicate with one another from time to time. No base stations are supported. Each host is equipped with a CSMA/CA (carrier sense multiple access with collision avoidance) transceiver. In such environment, a host may communicate with another directly or indirectly. In the latter case, a multi-hops scenario occurs, where the packets originated from the source host are relayed by several intermediate hosts before reaching the destination. The broadcast problem refers to the sending of a message to other hosts in the network. Any mobile host can issue a broadcast operation at any time.

The broadcasting is unreliable because no acknowledgement mechanism will follow in Broadcasting. However, many attempts should be made to send a broadcast message to as many hosts as possible without paying too much effort. The motivations to make such an assumption are:-

1. A host may miss a broadcast message because it is off-line, it is temporarily isolated from the network, or it experiences repetitive collisions,
2. Acknowledgements may cause serious medium contention (and thus another "storm") surrounding the sender.
3. In many applications (e.g., the route discovery in a 100% reliable broadcast is unnecessary.

In addition, it is assumed that a host can detect duplicate broadcast messages. This is essential to prevent endless flooding of a message. One way to do so is to associate with each broadcast message a tuple (source ID, sequence number).

Another Broadcast Storm problem Caused by flooding a straight-forward approach to perform broadcast is by flooding. A host, on receiving a broadcast message for the first time, has the obligation to rebroadcast the message. Clearly, this costs transmissions in a network of it hosts. In a CSMA/CA network, drawbacks of flooding include:

**Redundant rebroadcasts:** When a mobile host decide store broadcast message to its neighbors, all its neighbors already have the message.

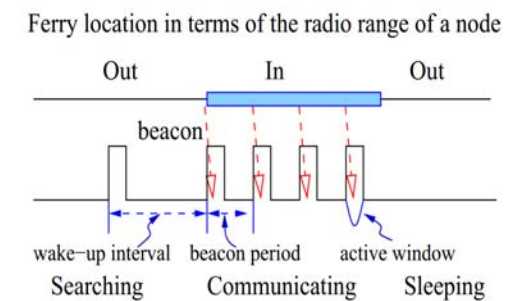


Fig. 5: (Power management mode of a node depending on the ferry location)

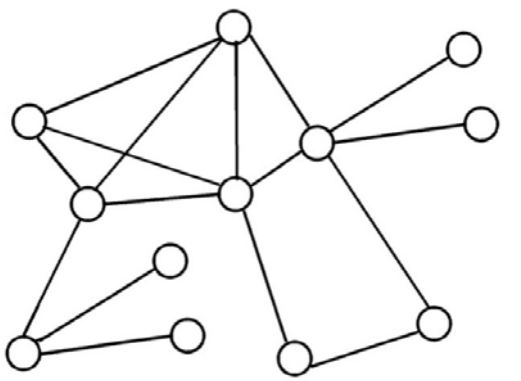


Fig. 6: (Changing Topology Star to Mesh & Mesh to Star in MANET)

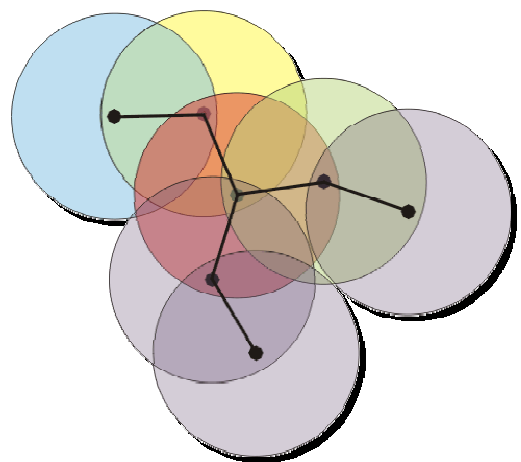


Fig. 7: (Broadcasting Range of every node in MANET caused to Broadcast Storm)

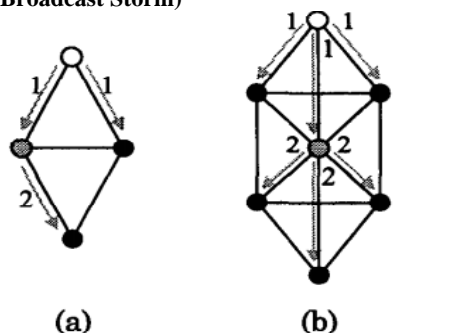


Fig. 8: (2 broadcast patterns in MANET's)

**Contention:** After a mobile host broadcasts a message, if many of its neighbors decide to rebroadcast the message, the set transmissions (which are all from nearby hosts) may severely on tend with each other.

**Collision:** Because of the deficiency of back off mechanism, the lack of RTSKTS dialogue, and the absence of CD, collisions are more likely to occur and cause more damage.

**Future work:** Collectively, the above phenomena can be referred by the broadcast storm problem and remained for future work.

## CONCLUSION

This paper has proposed some solution mechanism for MANETs to make reliable & stable with wireless links between the nodes. Due to some issues (i.e.; *Limited energy supply, Mobility of the Nodes due to constantly changing topology, broadcasting Storm*) it is proved that MANETs are unreliable and instable. In order to reduce the mentioned problems with MANETs some two solution has been proposed in the shape of protocol / communication model. To eliminate Limited Energy Supply issue a routing paradigm, Message Ferrying (MF), is proposed to save and protect energy while dealing data delivery delay. Message ferrying is a networking protocol model where a special node, called a message ferry, facilitates the connectivity in a mobile ad hoc network where the nodes are sparsely deployed. In other hand, due to continuously movement of nodes issue the main problems come in to the frond is routing configuration. To overcome the routing issue a solution has been suggested by implementing a Routing Protocol: *Dynamic Source Routing Protocol (DSR)*. The DSR is very easy and effective routing protocol designed specifically for those networks that have multi-hop in MANET. The third problem Broadcasting Storm is caused by DSR Protocol is remained for future work.

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